Comment on "Material evidence of a 38 MeV boson"

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(on behalf of the COMPASS collaboration)

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In a recent preprint [1] it was claimed that preliminary data presented by COMPASS at recent conferences [2, 3] confirm the existence of a resonant state of mass 38 MeV decaying to two photons. This claim was made based on structures observed in two-photon mass distributions which however were shown only to demonstrate the purity and mass resolution of the π^0 and η signals. The additional structures are understood as remnants of secondary interactions inside the COMPASS spectrometer. Therefore, the COMPASS data do not confirm the existence of this state.

In Figs. 1 and 2 we show these two-photon mass spectra next to the plots that were extracted from these and shown in Ref. [1].

The structure the authors of Ref. [1] focus on is one from among several such structures observed near the low-mass edge of the spectrum. There are several mechanisms how such structures come about. Firstly, secondary π^0 mesons produced in the detector material downstream of the target lead to $m_{\gamma\gamma}$ below the nominal π^0 mass when reconstructed assuming a target vertex. Material concentrated in detector groups leads to peak-like structures. Likewise, secondary e^+e^- pairs from photon conversion in the spectrometer material lead to low-mass structures. Cuts applied in the reconstruction software lead to additional structure in the low-mass range. These artefacts are reproduced in the Monte Carlo simulation for the reactions under study, using a complete description of the spectrometer material and employing the same reconstruction software as for the real data analysis. As an illustration of this, we show in Fig. 3 two-photon invariant mass spectra from the Monte Carlo simulations used in the analysis of $pp \to p\omega p$, $\omega \to \pi^-\pi^+\pi^0$ studied in Ref. [2]. We emphasize that no physical states below the π^0 mass are included in the MC event generation.

In conclusion, the data do not support any interpretation of these structures in terms of new resonances.

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[1] E. van Beveren and G. Rupp, "Material evidence of a 38 MeV boson," `arXiv:1202.1739 [hep-ph]`.
[2] **COMPASS** Collaboration, J. Bernhard and K. Schönning, "Test of OZI violation in vector meson production with COMPASS," in *Proceedings of the XIV International Conference on Hadron Spectroscopy*, B. Grube, S. Paul, and N. Brambilla, eds., eConf C110613. 2011. `arXiv:1109.0272 [hep-ex]`. `http://www.slac.stanford.edu/econf/C110613`.
[3] **COMPASS** Collaboration, T. Schlüter, "The exotic $\eta'\pi^-$ Wave in 190 GeV $\pi^-p \to \pi^-\eta'p$ at COMPASS," in *Proceedings of the XIV International Conference on Hadron Spectroscopy*, B. Grube, S. Paul, and N. Brambilla, eds., eConf C110613. 2011. `arXiv:1108.6191 [hep-ex]`. `http://www.slac.stanford.edu/econf/C110613`.

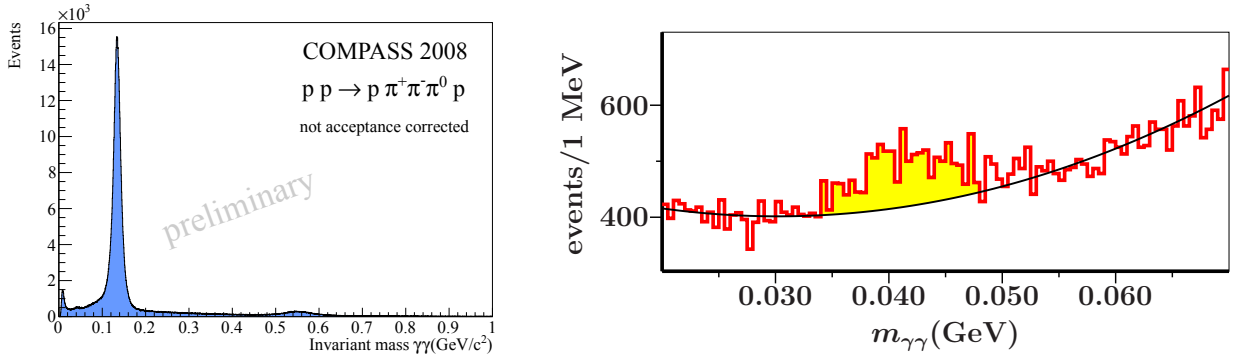

FIG. 1. Two-photon mass spectrum from an intermediate step of the selection of $pp \to p\omega p$ [2] (left) and the plot extracted from this by van Beveren et al. [1] to support the observation of a light boson with mass around 40 MeV.

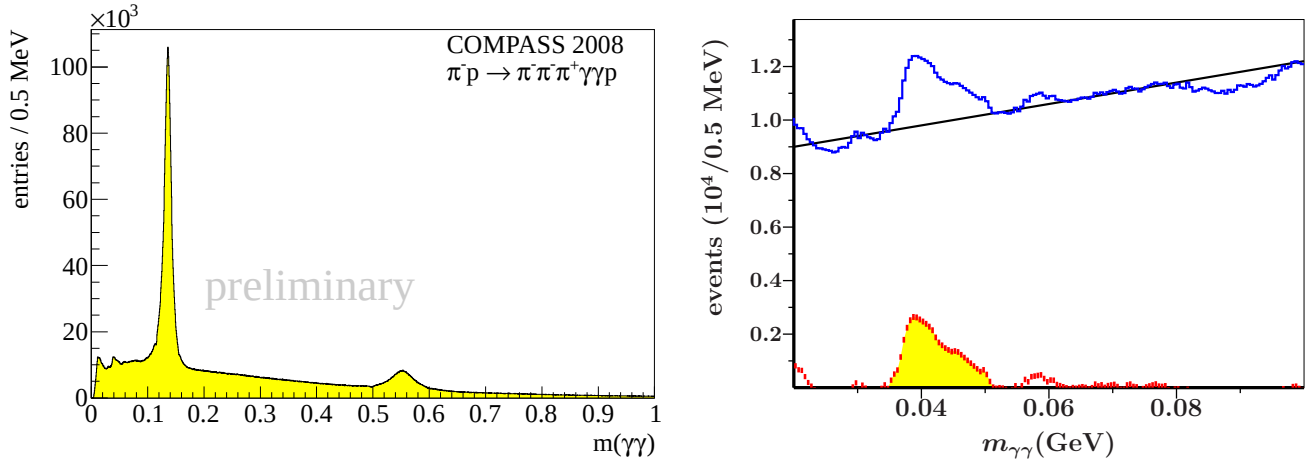

FIG. 2. Two-photon mass spectrum from an intermediate step of the selection of $\pi^- p \to \pi^-\eta'(\pi^-\pi^+\eta)p$ as shown by the COMPASS collaboration [3] (left) and the plot extracted from this by van Beveren et al. [1] to support the observation of a light boson with mass around 40 MeV.

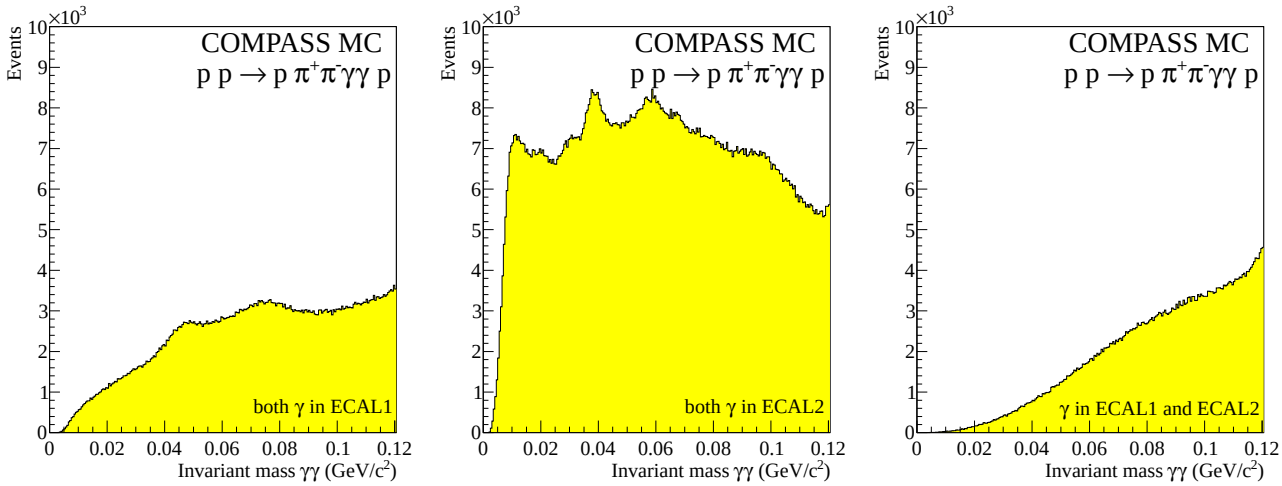

FIG. 3. Two-photon mass spectra below the π^0 peak obtained from simulation of in-target interactions $pp \to p\pi^-\pi^+\pi^0 p$ for the analysis described in Ref. [2]. The plots show the spectra for the two photons reconstructed in different combinations of the calorimeters in the two spectrometer stages. The visible peaks are caused by secondary interactions of the outgoing hadrons.